
A Treatise on Malting,

BY

JOHN LONG.

Published by order of the Dublin Society.

'THE Society desires it to be understood, that as a body, they are not responsible for any opinion or representation of facts, contained in the following papers, and will be much obliged to any gentleman, farmer, or other person, that will be pleased to point out any error, or improvement in the several matters treated of, by letters addressed to their Acting Secretary, the Rev. Dr. Lyster, Hawkins-street Dublin.



A
T R E A T I S E
ON
M A L T I N G,
DEDICATED
TO THE
RIGHT HONORABLE AND HONORABLE
THE
DUBLIN SOCIETY,
BY
J O H N L O N G,
General Examiner and Inspector of Breweries.

DUBLIN:

Printed by WILLIAM SLEATER, NO. 28, Dame-street.
[PRINTER TO THE DUBLIN SOCIETY.]

M.DCCC.



TO THE
RIGHT HONORABLE AND HONORABLE
THE
DUBLIN SOCIETY.

THE author of the following treatise humbly offers his sentiments on a new construction of a malt-house, together with a more eligible method of steeping, flooring, germinating, and giving the proper degrees of heat on the kiln to the three different kinds of malt; and how to discover in buying corn the good from the inferior and damaged grain, and the ill consequences attending the use of the latter. He was principally led to dip into this mystery, on observing the material difference in that commodity here to that made in England, together with the many
A abuses

abuses, which are so conspicuous even at this day, and which loudly call for redress. The endeavouring to make good malt is not the study or interest of the maltsters of this kingdom in general, but how to lessen the King's duty and make the subject pay for nearly half made malt, which will ever continue to be the practice, until there is a law to oblige the makers of that commodity to sell by measure and weight judiciously blended together. For to a certainty the better the malt is, the lighter it will weigh, while the bad made malt retains its gravity, being sold by weight; for instance you will not have more on an average than twelve stone of good malt from sixteen stone of tolerable barley, and in many cases half made malt although from good corn will weigh considerably more than fourteen stone. I have good reasons to aver, that there has been for some time back, and continues so to the present period at least a one third of the malt that is consumed in the country, that does not pay the smallest duty. Nor does the evil stop here; for instead of letting the grain steep from
fifty

fifty to seventy-two hours, according to the quality of the grain and the heat of the atmosphere to prepare it for germination, they divide seventy-two hours allowed by the act between two steepings, each part of which receives but little more than half the time requisite in the steep or flooring, which causes it to retain its original weight, which ought to have been lost in vegetation; and this intentionally bad made malt is entitled to and receives the bounty, nor can the best judges say, but it is malt of some denomination. And thus the brewers are deceived in the goodness of their malt, and the distiller pays for almost raw grain, which practice renders the former incapable of making good beer, from any quantity of such malt, and the latter too often obliged to work without profit. All which evils it is to be sincerely wished will be speedily redressed by parliament, since the consideration of this national and important branch of agriculture, the basis on which the prosperity of the kingdom in some measure depends, has been laid open and taken up by your patriotic and laudable society.

No. 1. A grain of raw barley opened, and its germinating parts left visible.



No. 2. The barley just taken out of the steep and frame after remaining 4 days in both.



No. 3. When on the floor 48 hours, and in this state if made into malt, it would weigh 15 stone per barrel.



No. 4. Four days on the floor, about $14\frac{1}{2}$ stone per barrel.



No. 5. Six days on the growing floors, about 14 stone per barrel.



No. 6. Eight days on the growing floors & heaped to the upper, about $13\frac{1}{2}$ stone per barrel.



No. 7. Ten days on the floors, about 13 stone per barrel.



No. 8. Twelve days on the floor, and ready for the kiln, about 12 stone per barrel.



P R E F A C E.

The History of a grain of Barley,
from its being thrashed until
it is made into Malt.

BARLEY has several component parts, earth, salts, oil, &c. &c. and the universal menstruum water, and thus it stands in the natural state as in N^o. 1, before it undergoes the operation of malting; to commence which, it must be immersed for a given time in water; for water being of a subtile nature insinuates itself into the minute or capillary vessels of the grain, and softens and disunites the bonds that nature gave to keep each particle together. Being thus softened, germination commences internally, altho' not visibly: (germination is accelerated or retarded in exact proportion to the heat, cold, or moisture it receives;) the number of

B

small

small fibres, that proceed from each grain, as in Nos. 2, 3, &c. &c. is the root, (or cone as it is called) that first shoots or makes its appearance in the malt-house, as well as when sown in the ground. How wonderfully Nature operates! before the acrospire or stalk appears, the radicles or cone have previously spread their different fibres or mouths for collecting nutriment from every thing within their reach, and by that means are enabled with more vigour to push forward their numerous shoots, and so come to full maturity in the fields. For though both root and acrospire proceed from the same spot or eye in the grain, they take different directions: the radicles descend to perform their functions below, while the acrospire rises to meet the influence of the Sun. It is curious to observe, how nature has allotted a part in each grain, which is situated at the thickest end, or next the stalk or ear that it grows on, as in No. 1, where the part intended for germination is seemingly lapt up, and unconnected with the rest of the grain; nor does the acrospire or stalk in the growth pass through
the

the body of the corn, but along the back internally, causing a small indentation on its body, and a visible protuberance on the external coat, that contains it, as far as the growth reaches, as in Nos. 2, 3, 4: but examine the grains that had not vegetated on the floor, and the part, from whence germination should have sprung, appears whole and entire. Hence it remains raw barley, and not possessed of any degree of sweetness.—I have cut the grain across for the experiment, and took but a one-fourth for one part, and three-fourths for the other, and tried if each would germinate, but in vain: for the upper or greater part would never sprout, while the other end would readily throw out its shoots, though unassisted by the greater part of the grain. If the acrospire, which is creeping from the root along the grain between the skin and body, had reached the end opposite the root as in No. 9, and made its appearance there, the grain would be materially weakened by this excessive growth, and but little saccharum let to remain.—The fibre, that formed the root, drew in the first instance

from the body of the grain a given quantity of its oleaginous and earthy particles, which it is requisite the corn should be dispossessed of in the formation of malt. Then the acrospire extracts or draws in its growth a certain portion of nutriment composed of mucilage, and its other component parts, which, although it lessens the grain a one-fifth, yet, by being dispossessed of these grosser parts, the kernel that remains is possessed of a saccharine taste, which is the true basis for making good malt liquor and spirits in general; but if the acrospire had been suffered to appear, by so much would the malt have been impaired.—When the grain has been brought to the highest state of vegetation on the floor, the skill of the maltster is then peculiarly necessary: for by wide spreading his couch, and giving it a more elevated, dry and airy situation, with thin flooring and repeated turning, he will in a most surprising manner lessen and stop this vegetation, and in a few days it will begin to wither on the cone, and be ready to undergo its last operation, which it receives on the kiln.

So

So much as each barrel of barley made into malt weighs more than twelve stone, so much is his Majesty defrauded of his revenue, and the brewer and distiller cheated by the maltster. Let us for a moment look to the fountain from whence regularity flows, and there we will find that the interest of the English maltsters is to make perfect malt. For the longer they draw the acrospire on the back of the grain, which is done by giving it sufficient time and work on the floor, the larger it will swell; and as the judicious method is to sell by measure and not by weight, the bushel is the easier filled. But our injudicious practice being to sell by weight instead of measure, it is an inducement to our maltsters to detain the specific gravity in the malt to the great destruction of the brewers in particular, and which has been the sole cause of their not succeeding in that necessary article of life, as well as obliging the distillers to pay for little more than half-made malt. By this means the revenue is defrauded, and this must continue to be the case until there is a law made to sell by measure and not by weight.— Thus it

must

must fully appear, that all the specific gravity, that remains in the barrel or sixteen stone of barley that is made into malt weighing above twelve stone on an average, is the oleaginous, acid, and earthy parts, that ought to have been drawn by the radicles and acrospire while on the floor, which would have rendered the malt a mass of saccharum or sweet, instead of being gross and ill-flavoured.

Were it possible to get the maltsters of this kingdom to work what is called fair, and not to have a steep without serving a notice it would be just and proper. As that is not at present the case, I will take upon me to prove they have a one-fifth of the duty saved from the following simple practice. Suppose a steep to contain twenty barrels of barley, the officer charges them duty for sixteen barrels; for it is alledged that the grain swells in the steep the other fifth, (which is never the case) but the fact is this; they put instead of sixteen barrels nineteen at least, and the top of the steep is so contrived that it will on occasion, or having an obliging officer, hold a few barrels more than

than when it was gauged ; for should the corn rise several inches higher than the level of the water in the steep, which is in the face of the law, they will tell you it was the dryness of the corn that caused it to swell to that degree, when in fact it was the increased quantity.—When it is once got out of the steep and frame, no officer can possibly ascertain the quantity, their allowance for its increased bulk is so great ; and as the intention of maltsters is then to check its growth, the supposed charge of the steep, or sixteen barrels, with art will turn out twenty-one barrels, not by measure, but by detaining the specific gravity which they sell by.

than when it was gauged for the first time. The level of the water in the trough which is in the face of the dam will not rise it was the object of the dam that caused it to swell to other degrees when it is once got out of the trough and frame, no officer can possibly ascertain the quantity of their allowance for the increased bulk is to great; and as the intention of masonry is then to check its growth, the supposed change of the level of the trough is not by measure, but by determining the level of gravity which they will be.

It is a well known fact that the level of the water in the trough will not rise it was the object of the dam that caused it to swell to other degrees when it is once got out of the trough and frame, no officer can possibly ascertain the quantity of their allowance for the increased bulk is to great; and as the intention of masonry is then to check its growth, the supposed change of the level of the trough is not by measure, but by determining the level of gravity which they will be.

THE TREATISE
ON THE
ART OF
CONSTRUCTING
DAMS
AND
TRoughs
FOR
THE
PURPOSE
OF
RAISING
WATER
TO
A
CERTAIN
LEVEL
AND
OF
KEEPING
IT
AT
THAT
LEVEL
UNTIL
IT
IS
USED
FOR
MILL
WORK
OR
OTHER
PURPOSES.

T R E A T I S E
ON
M A L T I N G.

THE process of malting is thought to be so universally understood, that to say any thing new on the subject would perhaps give offence, or to descend into the minutiae might by some be deemed unnecessary: yet I shall take the liberty (through the medium of this laudable Society) to offer my thoughts for the perusal of those few that are convinced the subject is yet capable of improvement. Malting is a chemical process, and in that light not so generally understood as could be wished: it is in some measure a kind of forced vegetation, and the nearer we follow the laws marked out by nature, the more certain we are of arriving at the highest state towards perfection, that humanity is capable of obtaining.

It is a lamentable truth, that in an endeavour to improve there are many and great difficulties to be surmounted, none of which militate so strongly, or with such efficacy, as inveterate and long established custom. To custom there is certainly a deference due, but when reason and experience have proved a custom to be of an unprofitable, if not pernicious tendency, who will be so hardy as to contend that such custom ought not to be abolished? None will, but all cry out for proof; yet when they have received almost an ocular demonstration, they shut their eyes against conviction, and, obdurate in error, suffer themselves to be overborne by prejudice and received opinion, though like an ignis fatuus it should lead them into difficulties, dangers, and the most glaring absurdities. So many instances of this occur every day, that none can doubt the truth of my position.

I shall now in a brief manner proceed to give the outlines of the chemical process of malting barley and other grains.

Malt is generally made from barley or bere, and sometimes from oats and wheat, but barley is made use of in preference to any other grain for malt in England, in a ratio of nineteen to twenty, and it is becoming nearly so in Ireland. Forty years ago, it was but a very inconsiderable article to what it is at this day in England, and since that period it has so increased, that at this
it.

time it brings in a revenue to the Crown of more than two millions yearly, by a duty on malt, and excise on spirits and different beers; nor is this country at present in proportion to its wealth and inhabitants much behind England in the growth of corn in general; for by the care and never to be forgotten attention of certain gentlemen of Ireland, agriculture has been within the last twenty years improved, increased, and now extended to the farthest corner of this fertile island, the sweets of which have been so sensibly tasted, that it is to be hoped no time will be able to lessen it.

Peas, beans, potatoes and carrots have been malted, but to little effect; for peas are in general dearer than barley, and don't prove so profitable; and beans, when malted, will not have a pleasing flavour in the liquor. There is scarce a vegetable that the earth produces but is possessed of more or less fermentable matter or essential oil: all the aromatic tribe will, in the act of distillation, throw over their volatile oils, without undergoing the least degree of fermentation; but this is not the case with the different grains malted or unmalted, for there will not appear the least spirit in their strongest solution until it undergoes a certain degree of fermentation; but barley, when malted, is found to possess more saccharum than can be had from any other vegetable yet known in England or Ireland at the price. When I speak of barley I in some measure allude to the other

grains. Barley has several component parts, earth, salts, oil, &c. and the universal menstruum water, and thus it stands in the natural state before it undergoes the operation of malting. I have made several experiments on malting, and will endeavour to explain some of the wonderful effects of art and nature combined in this process. In a vessel I had some barley immersed in water at the temperature of 55° , which lay in that state for fifty hours, and the only visible effect the water had on it was the fulness the grain had acquired; for water being of a subtile nature insinuates itself into the the minute or capillary vessels of the grain, and softens and disunites the bonds that keep each particle together, which being thus softened, germination commences internally, although not visibly. I had in a second vessel some of the same parcel of the grain, which had lain seventy-two hours. The water had been kept at so low a degree as 38° , which exceedingly checked its progress, for germination is accelerated or retarded in exact proportion to the heat, cold, or moisture it receives. The parcel, which was steeped in the water at the temperature of 55° , vegetated sixteen hours sooner on the floor than the latter, notwithstanding it was taken out of the steep fifteen hours sooner, and I was obliged to have the couch made considerably thicker with an intention to increase its heat, before I could accomplish my design. The number of small fibres, that proceed from each grain, is the root (or cone

as

as it is called) that first shoots or makes its appearance in the malt-house, as well as when sown in the ground. How wonderfully nature operates! Before the acrospire or stalk appears, the radicles or cone have previously spread their different fibres or mouths for collecting nutriment from every thing within their reach, and by that means are enabled with more vigour to push forward their numerous shoots, and so come to full maturity in the fields: for though both root and acrospire proceed from the same spot or eye in the grain, they take different directions; the radicles descend to perform their function below, while the acrospire rises to meet the influence of the Sun. It is curious to observe, how nature has allotted a part in each grain, which is situated at the thickest end, or next the stalk or ear that it grows on, where the part intended for germination is seemingly lapt up, and unconnected with the rest of the grain; nor does the acrospire or stalk in the growth pass through the body of the corn, but along the back internally, causing a small indentation on its body, and a visible protuberance on the external coat that contains it as far the growth reaches: but examine the grains that had not vegetated on the floor, and the part, from whence germination should have sprung, appears whole and entire, hence it remains raw barley and not possessed of any sweetness. I have cut the grain across for the experiment, and took but a one fourth for one part, and three fourths

fourths for the other, and tried if each would germinate, but in vain; for the upper or greater part would never sprout, while the other end would readily throw out its shoot, though unassisted by the greater part of the grain. If the acrospire, which is creeping from the root along the grain between the skin and body, had reached the end opposite the root and made its appearance there, the grain would be materially weakened by this excessive growth, and but little saccharum let to remain. The fibre, that formed the root, drew, in the first instance, from the body of the grain a given quantity of its oleaginous and earthy particles, which it is requisite the corn should be dispossessed of in the formation of malt; then the acrospire extracts or draws in its growth a certain portion of nutriment composed of mucilage, and its other component parts, which although it lessens the grain a one fifth, yet by being dispossessed of these grosser parts, the kernel, that remains, is possessed of a saccharine taste, which is the true basis for making good malt liquor and spirits in general; but if the acrospire had been suffered to appear, by so much would the malt fall short of perfection. When the grain has been brought to the highest state of vegetation on the floor, the skill of the malster is then peculiarly necessary: for by wide spreading his couch and giving it a more elevated, dry, and airy situation, with thin flooring and repeated turning he will in a most surprising manner lessen and stop this vegetation, and
in

in a few days it will begin to wither on the cone and be ready to undergo its last operation, which it receives on the kiln. Here it is spread from four to six inches thick and receives a certain degree of heat either from coke, Kilkenny coals, or others equally free from smoke, which with often turning first absorbs the damp or aqueous particles, and after being perfectly dried gives a crispness to the grain, which, if chewed, will leave a remarkable sweet flavour on the palate. When it is requisite to give a high colour or particular flavour to the malts for porter, &c. they in the last stage feed the kiln with wood, which gives a certain flavour to the amber, parched, or brown malts.

Having now in as concise a manner as I was able endeavoured to explain the chemical process of malting, I shall next proceed to the instructions necessary for erecting a malt-house on an economical plan, the construction of which will, I hope, meet the approbation of the chymist and of the unprejudiced.

The
 of
 wh
 wi
 of
 ne
 his
 en
 if
 hu
 sh
 gra
 of
 thi

C O R N,

AND CHOICE OF IT.

THERE are several observations necessary for the malster to make, with respect to the choice of barley, &c. First to consider the harvest, whether good, middling, or bad in general; likewise to know the different counties or quarters of the kingdom, and the nature of the soil as near as possible that the grain grew on; then from his own observations in a few seasons, he will be enabled to make judicious and profitable remarks; if the corn looks plump and bright, and the husky coat smooth and not inclined to be much shriveled, it is an indication of the goodness of the grain in general; if the corn consists of five eighths of a tolerable large grain, two eighths of something less in size, and a one eighth at most of an

D

inferior

inferior quality, you may compound and say that it is altogether a middling sample; for the farmers in Ireland do not divest their barley and bere of the inferior corn, which is never sent to the English market. Care ought to be taken to avoid if possible buying barley, &c. that was reaped in bad weather, or had received much wet in the field; for it follows that germination of a greater or lesser degree has taken place, although not visible to the naked eye, and that damage will militate against its making good or sweet malt. The truth of this I fear will be severely felt this season; but by breaking and carefully examining the grain, assisted by the taste, you will be enabled to make proper observations. People of refined judgment in the business say, that barley, &c. ought to ferment in the mow or stack before made use of: for my part I see no harm in a small degree of heat diffusing itself, which will cause an equal distribution of moisture, but at all events let it be well taken in from the field, and, if the corn is good, the other requisites will naturally follow.

Specific gravity in all grain is a proof of the quantity of flour it possesses in preference to bran or chaff. What I mean by specific gravity is, if a vessel contains exactly one quart of barley, which for argument sake weighs twenty-two ounces, if another sort should be put in the same
measure

measure and weighs twenty-four ounces, and a third and superior sort weighs twenty-six ounces or upwards, and all this corn be properly dried, that, which has the greatest gravity in the same space, must of course have more farina or flour, and considerably less chaff than the two former samples, and will, when made into malt, have a much greater produce for the brewer and distiller, the knowledge of which may be easily ascertained by a simple instrument made for the purpose (in Dublin by Robinson) which every dealer in corn ought to be in possession of, as in an instant it declares the goodness of one parcel of corn from another, by its superior gravitation; so that the dealers in corn might bring into market samples of the different grain in small bags, not to contain more than a pint honestly taken from the different heaps, &c. And when purchased, the buyer to bring home the sample bag closely sealed, or the purchaser and seller to divide the contents of the large bag between them, to compare when the whole is delivered, and, if the quantity falls short in quality of the sample, two honest men for the present might decide the difference, and if the factor, grower, or buyer is in fault, it would materially injure their characters in future as honest and upright dealers. All the malt and raw grain is bought at the Corn Exchange London by sample, and it is seldom known that a fraudulent one is produced, as the existence

tence of the factors depends on their strict honesty, and to the honor of this kingdom I will say, that I personally know some factors in this city, whose bare word can be relied on in their dealings, and it is to be hoped, that universal confidence between the buyer and seller will every day increase with our wealth, for the mutual advantage of all concerned.

SITUATION

SITUATION.

THE maltster ought to lay out the ground for the building of his intended malt-house, on the lowest part of his concerns; let it be so situated that floods cannot injure it, let the lower floor be depressed at least six feet below the common surface of the yard, so that the second floor will be something lower than the level of the ground. If you mean to have extensive floors, and to come on reasonable terms, let every twenty-two or twenty-four feet in the breadth of your intended malt-house have pillars of brick or stone work, nearly three feet in diameter and about twelve feet asunder to support the floors and roof; for if you build on arches they become expensive though ever so low, nor can the workman with ease get under them to turn the corn; but beams of proper dimensions will be able to sustain any weight. From such a mode of building your floors need not be more than five feet six inches

inches asunder in the clear, and the grain will be with more ease trapped or pitched from the lower to the upper floors, and there will be head room sufficient. Let your floors be made of lime, sand, coal-ashes, and as much of the iron, that falls under the hammer, or filings from the vice as you can easily collect; these properly tempered with blood are great cementers, and of course very durable. Let this compost be often turned before made use of; let the lower floors have but few apertures to open or shut occasionally, to admit or exclude light or a thorough air; for having it thus in your power, you greatly increase or retard germination on the floors. Deep sinking has this good effect, that your lower floors are always several degrees warmer in the winter months than the upper ones; as the deeper you descend in cold weather the more you are excluded from the frozen atmospheric air, as it is well known, that at an inconsiderable depth there is an internal heat, which operates visibly even at the depth of seven or eight feet from the surface, and it is equally certain, that in the warmer seasons at about that depth the air will be much colder than on the surface. Hence deep sinking is of infinite use to the maltster in keeping the natural heat in the bosom of his couch in the inclement seasons, and considerably colder in the warmer months. My intention in making this statement is, to endeavour to point out to the working maltster the great use of the thermometer, as
it

it will plainly demonstrate all those circumstances, and prove, that it is highly requisite, that he should be well acquainted with the heat of the atmosphere within doors and without, in his under and upper floors, while he continues to germinate the different sorts of grain. I am well apprized, that there are many, who are acknowledged to be good maltsters, yet have never seen, or perhaps heard of the instrument I mentioned; but I hope it will not give offence if I tell them, that, if they practically understood its valuable information, their own reason would shortly make them as great advocates for its use as I am. By observing the weather with the help of this instrument your couch would not be so much retarded in the inclement seasons, and in the warm months it might prepare you to prevent your grain from germinating too fast; for the best judges in the business may be easily deceived as to the exact heat of the atmosphere from want of judgment, excess of labour, or many other incidental causes; but the instrument cannot err. Let the windows of your second and third floors come as low as the grain on the lofts; let the weather shutters be made so as to fully open, or half open, that at all times you may admit or exclude the external air, which will absorb the aqueous parts from the grain, and first retards and in a little time effectually stops vegetation.

S T E E P

S T E E P.

IT is a matter of no great moment, whether your steep is made of brick or stone work, lead, or even timber, provided it is perfectly staunch; but by all means let it be so contrived, that those on a large construction may have two, and in some cases a third division, as it will answer many good purposes, and come considerably cheaper than having different small ones made: for, as your grain is or ought to be divided into two or three distinct parts, each part should be steeped by itself. By having these divisions your business need not be retarded for not having your full complement; for how many maltsters in both town and country are obliged to stop for some days together at certain seasons to collect an hundred barrels more or less nearly of a quality, and proper to be put into the same steep. Besides the maltster ought on no account to have his steep larger than what will be properly dried

on his kiln or kilns: for the size of the steep ought to be regulated by the size of the kiln, as the letting any part of your vegetated grain continue from twenty-four to thirty-six hours longer than another part of the same parcel is highly pernicious, and as the revenue laws oblige them to have four fifths of a steep, or to pay for its contents, those divisions would prevent the tradesman from any overcharge on the one hand, and any dispute with the officer on the other. Each division being gauged with accuracy, the idea of dispute would be soon eradicated, and in a little time harmony subsist between all parties.

It is customary for the maltster some time about the latter end of September to put his grain promiscuously into the steep, without once considering whether it is a mixt corn, or all grew on the same kind of land, or came from the north or south of the country, nor once separated the well grown corn from the smaller part of the grain, that had not received its full strength or maturity in the fields. The corn is thus put without the least reserve into the steep; but to prevent in future such a mistake, I have invented a simple piece of machinery, the cost of which will not exceed ten pounds, that with the assistance of two men will make three distinct sorts out of fifty barrels of grain in one day. This method attentively practised in a
very

very little time will evidently shew the working maltster the good, middling, and bad corn, and what time each will in general take in the common course of steeping, vegetating, &c. I would recommend a false bottom, one inch thick, of plank perforated with small holes not to admit the grain through, which would cause the corn to be strained from the water in the steep, into the frame almost totally and not partially divested of its aqueous particles, and any sediment from the water or filth from the grain would lie at the bottom, and not be thrown out among the corn, as in some places it is done.

All malt-makers ought to have a well sunk from nine to twelve feet deep, convenient to the steep, where they will in all probability meet a land-drain. The water from this will be several degrees colder than the common river water, that is exposed to the influence of the Sun and warm air in summer, and several degrees warmer in the winter months, being excluded from the frigid air, both of which circumstances will be of great use in wetting the corn. But, if the maltsters could be induced to adopt the following method, a little time would prove its great utility. Let there be a leaden or any other metal tube from two to four inches diameter, proportioned to the size of the steep (or steeps,) to pass from one end of them to the other about four inches from the bottom, and as near the centre

as possible; let the tube be connected with the cock of a small boiler not to exceed one hog-head of water for the largest steep, and smaller in proportion; let the largest half of the water necessary for the steeping of the grain be first put into the steep; then pass the hot water through the tube, and in five minutes put in your corn, for in that time the frigidity will have left the water; let the tube remain full, until it has diffused its gentle heat to the liquor in every part of the steep, and at the other end of it have a cock to let off the water, and so let through more or less at your own discretion, still keeping the steep at about 55° , of heat by Farenheit's thermometer in the frigid seasons. Why I recommend the tube so near the bottom is, to remind the working malster that heat always ascends; and this gentle glow from the tube will be sensibly felt in every part of the largest steep, and this may be continued for the first twelve hours, as all danger from excess of cold is in that time over. Now in the warmer months the well water will be much colder than the river water, but even it will increase in heat by lying from fifty-eight to sixty-eight hours on the goods as it generally does: but, if there was a quantity of the cold water from the well to pass through the tube, which conveyed the warm water in winter, it would keep the wole mats of the steep considerably colder, than if this method had not been

been put in practice; for the water on the goods at certain seasons of the year increases in heat several degrees.

It might in this place be asked, why not let off some of the overheated water from the steep, if any disagreeable matter appeared, and admit this colder water on the grain? If they did so, the corn would be weakened in exact proportion to the quantity of fresh water thus given. It is a practice with some to give a second liquor to the goods in the steep, which practice I totally reprobate, for the following reasons. All liquor let on the corn is more or less impregnated according to the time it lies on the grain, and the temperature of the air, the colder the less, and the warmer the more, which liquor if, when drawn from the grain, it was put into a state of fermentation, would produce by distillation a quantity of ardent spirits more than could be imagined;* hence a second liquor must impair and lessen the strength of the grain; but if the intention of a second liquor is to brighten or divest the grain of any dust, &c. let it not stand more than two hours, and the damage will be the less.

* The English maltsters are so well convinced of the value of this liquor, that they give it as drink to the black cattle and hogs.

When

When your thermometer stands at 33° , or lower, it is then absolutely requisite to use artificial heat, to take off the frigidity of the liquor intended for your steep, and raise it as near to 55° as possible, which will soften and disunite the germinating parts. At this frigid season let your corn in general lie seventy-two hours in the steep, for it will naturally in that time increase in heat some degrees, occasioned by a small tendency to fermentation. If the thermometer stands from 38° to 42° , your liquor still wants a small degree of artificial heat in the steep, and then you may take it out in sixty-two hours. When the thermometer stands from 44° to nearly 50° , it will then rest with yourself to know from experience, whether you shall assist your steep with any more heat. But when the instrument stands at 55° , or upwards, then let your water be as cold as the nature of your situation will produce: slow vegetation in warm weather is highly requisite for the completion of good malt, and at this degree of heat vegetation is brought more forward in the steep in fifty hours, than, when the glass stood at 35° , in seventy-two hours; for the maltster may rely on it, that a very considerable quantity of the grain would grow by this more gentle treatment, which, if steeped in the usual method, would never shew the least appearance of vegetation, but would remain to the end raw barley. And it follows in every part of the process, that heat promotes, and cold

cold retards germination; but no malt can be profitably made, when the atmospheric air is in the north shade more than 60° .

It is thought by many, that the best method of discovering the precise time the corn ought to remain in the steep is, when the grain is to a certain size swelled, and will easily give way between the finger and thumb, from a gentle pressure at each end. This method I would have great reliance on, provided all the grain in the steep was nearly alike; but that is seldom or never the case, and therefore in my humble opinion they cannot have a strong dependance on this appearance; for instance the corn of this season on an average will not take near so many hours in the steep as the corn of last year, and hence the grain from one farmer, that has been more fortunate than his neighbour in taking in his barley in better weather, will take perhaps twenty-four hours longer in the steep than corn, that had received considerable wet in the field. For we must remember that this is a chemical process, and to do it justice requires the greatest nicety; for the precise time it ought or ought not to continue in the steep is as difficult to be determined on by the best maltsters, as it is for the brewer to know the exact time, that his fermenting tun arrives at the acme of a complete vinous fermentation, which mystery is universally acknowledged by the best professors of chemistry, and the

the ablest practical brewers, to be even at this enlightened period above their comprehension to any degree of certainty; but long practice, close attention, and constant remarks in both cases, bring the workman through his business in a most surprising manner. But let us take the most pleasing side of the argument, and suppose, that the greater part of the corn in the steep is in good condition, it will on that account take a considerably longer time in it, that the water may have time to insinuate itself into its close texture, and soften and disunite the parts for growth, which will the better prepare it for germination. If we err, let us endeavour to be on the right side, and give it six hours too long, rather than one hour under what our best judgment pronounces sufficient; for if the corn should continue in the steep for several days together, it would not shew the smallest appearance of vegetation, and the only change it undergoes is the increasing of its size; but, if part of the same grain was put into the ground at the same time, vegetation would appear in October weather from the root the fifth day; whereas, in the steep, in the same time it would not throw out the smallest radicle: hence the natural heat in the bosom of the earth, assisted by the influence of the circumambient air, acts more powerfully on the grain in the ground, than even a continued lying in water. But it is not the case with already made pale malt; for take a given quantity of it, and
immerge

immerge it in warm or cold water, and in a few hours it will vegetate, or sow it in the ground, and it will grow in half the time that raw barley will, sown at the same time; hence it is evident, that all the germination, flooring, and even the violent operation in the kiln, has not, nor does not destroy all its vegetating parts. I have this from repeated experiments on different malts.

It is acknowledged, that in the warm months the liquor on the goods in the steep receives a livid hue, and becomes highly impregnated with a mucilaginous substance drawn from the grain; being thus situated, globuli appear on the surface of the steep, as if it had a small tendency to ferment, and those appearances are often attended with a fetid or disagreeable smell, which must materially injure the mucilage, or strength of the corn. To remedy this evil, I shall submit the following idea, with all due deference to the consideration of those conversant with the art of chemistry, whether it will not be of great use, especially in the warm seasons, to saturate the water in the steep with a given quantity of calx made from chalk, before the corn is put into it, which will help to purify the water, being an antidote in a great measure to every thing, that has the least tendency to a putrefactive state.

I expect there are many, who will object to this method, and perhaps say, that lime admitted

F

amongst

amongst the corn for making sweet malt carries a contradiction on the face of it; but let them observe the small quantity made use of (about four ounces to four hundred weight of water) which is wholly employed in destroying every thing, that has the least tendency to putrefaction, and in rendering the fluid totally unfit for the existence of the numerous animalcula, which in those warm months too often infest the steep, so that no part of the calx is left with any degree of strength to operate even on the husk; hence it cannot be pernicious to the internal part of the grain; but, were it possible that any part of the lime could be let to remain, the malt would not be injured, as I have known a small portion of lime intentionally made use of in breweries, and a considerable quantity in the art of distillation. There is a part of the corn intended for the steep, which is, in some measure, in a putrid state before it is admitted; and nearly a one tenth of the whole, of a weak, feeble, and inferior sort, that no time would cause to germinate, all which helps to render the steep impure; but, if the corn was divested of those pernicious parts by the help of the machine, it would be a means of keeping the liquor pure, and in that case it would be a judicious method, in the winter seasons, to return the liquor drawn from the grain, after it had performed its function there, and admit it on a second steep of raw corn, as it will prove more efficacious on the goods than fresh

fresh liquor, as being highly saturated, it cannot imbibe the smallest particle of mucilage from the latter, which would be a clear saving of five per cent on the contents of each steep.

I now appeal to the maltsters of this kingdom, if it is not the practice to admit the water on the grain in the steep, without paying the least attention to the temperature of the air, or whether the thermometer stands at 30° or 60° , whereas so low a degree, as from 30° to 40° , not only retards what is at this time so much wanting (germination) but, if I may use the expression, chills the life of the healthy corn, and deprives the feeble and sickly grains of existence. I think I hear some say, that, though they have had the bosoms of their steeps many times frozen, yet they never spoiled one steep in the course of their practice. Heaven forbid! for the back is generally prepared for the burthen in the vegetable as well as in the animal kingdom; but surely the most obdurate will not be hardy enough to insist, that frigidity can possibly be a prompter of growth, or that the grain is better for undergoing such a violent operation, whilst it absolutely contradicts the very end they are about to accomplish. But is it not a happiness to many thousands, that in their own despite the curtain of darkness is torn from before their eyes, which, when considered properly, will improve their naturally good understandings.

FLOORING.

F L O O R I N G.

WHEN the corn is thrown from the steep into the frame, let it lie thirty hours in winter, and something less in the temperate seasons, as its continuance in that great bulk divests it of its aqueous parts, and excites heat, which forwards germination. If the weather continues nearly at the frozen point, let your first couch be from twelve to twenty-four inches thick, and it may perhaps remain in that situation from twelve to eighteen hours. If you work with a thermometer, put the bulb into the centre of the couch and cover it, and in a few minutes it will inform you of any, or what increase of heat it has arrived at, and how soon you shall open or continue it in that situation, and what thickness your next couch ought to be; for the best workmen cannot with precision say, at what time the couch ought, or ought not to be opened, as it entirely depends on the heat or frigidity of the atmosphere, of which the instrument will give you the earliest information, and direct your working accordingly. But, if the weather should be nearly temperate, then your first couch ought not to be more than from four to six inches thick,

thick, and perhaps will require to be opened the first time from six to eight hours, as it will in warm weather come more forward in a few hours, than in twenty-four hours in the cold seasons.

If you find your grain, after being from twenty-four to thirty-six hours on the lower floor, (still turning it as your judgment must direct) germinating too fast, perhaps from a sudden change to a warmer point, turn it the oftener, open your lower shutters, and admit a thorough air, which will give it a small check: but, if it continues to increase with any degree of rapidity, spread it considerably thinner, throw it high, and let it fall like a shower, and turn it repeatedly, which will in a short time so check vegetation, that you may have it fully in your power to keep it stationary, or to bring it forward at your liking. Let the workmen endeavour as much as possible, in the turning of the corn, to put the top and bottom of the former couch into the centre of the new one; but, if you neglect turning the corn on the floor for any length of time, it will unite and malt from its rapid growth, and quickly pass from a vegetative to a putrefactive state. After your grain is traped or put into a more elevated situation, for the purpose of checking the growth of the root, (or cone as it is called) which is generally done after the sixth or seventh day, the acrospire still continues its internal growth,

growth, passing along the back of the corn, to whatever length the judgment of the workman will allow it to arrive at. I would recommend a magnifying glass for the workman, that has not a quick eye, which will clearly discover the exact length of the acrospire from its protuberance. At this crisis it is incumbent on the workman to be watchful, that the acrospire do not break its cerment and appear, as that will be proof positive that the corn has vegetated too much. But a chance grain may have this appearance, and at the same time the remainder be well made: but one grain in an hundred in this state would be very alarming, as the malt would be considerably weakened, and of course greatly lessened in its value.

When the grain is put on the upper floors, the thickness, or wide spreading of the couch, will depend in a great measure on the situation it was in leaving the lower floor, together with the temperature of the air; but avoid forcing, by thick flooring, vegetation with violence in any stage, as the rapid growth impairs the germinating parts more, than if gently brought forward by time and labour. But, if the grain should not vegetate fully to your satisfaction, sprinkle your floors lightly, open the couch the seldomer, give it less air, and increase its thickness, which will in a surprising manner accelerate vegetation. All malts ought to be thrown in a heap on the floor

floor from twelve to eighteen hours prior to their being put on the kiln, as by exciting a small degree of heat it causes an equal distribution of the moisture, and the better prepares the grain for the reception of the empyreuma on the kiln.

The maltsters ought to work on the floors in slippers, that will not break or damage the grain, as that prevents it from vegetating, and therefore it will not malt. They ought also to be particularly careful to keep the floors as free as possible from scattered grains.

K I L N.

K I L N.

THERE has been introduced within these few years a kiln on a much better construction, than those formerly made use of, but I shall not take up your time by descanting on the virtues or vices of either, but attempt to offer an improvement on both, that will I hope materially serve many hundreds in this kingdom.

It is admitted, that malt dried with turf, or coals, that produce much smoke or sulphur, is highly injurious to the brewer and distiller, as their beer and spirits receive a bad taste from using such fuel. To remedy this as much as possible, I shall submit the following idea to the consideration of the impartial. Let us suppose a kiln made on the new, or old construction, and that there was a cockle of metallic substance of three feet in diameter, more or less according to the kiln, and fixed as near the centre as your judgment will direct, still reserving a sufficient passage without side to supply it with turf. Let there be placed a spark iron immediately over the cockle, which will regularly disperse the
partial

partial heat from the centre through every part of the kiln; let there be one main tube in the centre of the cockle to let out the smoke, two feet high, and six inches in diameter; and let there be four small ones of three inches in diameter, made of sheet iron rivetted to the tube, to act as chimneys, and to take different directions, to convey the smoke entirely out of the house, and diffuse the heat in its passage to every part. Being thus situated, the black, or most disagreeable smelling turf may be used in this cockle, and completely finish the pale malts, as no part of the smoke can from this method interfere with the malt while on the kiln. There are great numbers in this kingdom, whose spirit of industry is considerably checked, from their being far removed from all kind of coals, more especially those calculated for drying malt, which great inconvenience this plan will entirely remove. If the smoke or sulphur of coals, passing through the malt on the kiln, is requisite to increase its sweetness, then my plan must fall to the ground; but if heat alone is efficacious, let it be obtained from what fuel it may, then turf is equally valuable with the best coals in drying pale malts. For it is allowed, that the best Kilkenny coals are impregnated with sulphureous particles, and the far greater part rendered so offensive from their dangerous tendency to suffocation, that they have at times deprived many persons of life, who unfortunately burned them in their apartments.

Now whether the malt from being dried with such fuel receive a virtue or a vice, must be determined by a better judge than I can possibly pretend to be.

Let your malt, when sufficiently dried, be taken from the kiln and cooled as soon as possible, that the external air may have an opportunity of replacing the loss of the excluded fixed air, which was dissipated by the excessive heat on the kiln. For, if the brewer was to work the malt in this warm state, its produce of saccharine or fermentable matter would not be near so great, as if left to cool, and to be fully saturated by the external air, which never fails to soften and meliorate it exceedingly. If malt were permitted to lie at least four months, after being made, in a situation free from damp, it would be of infinite use as to the quality, and would render it in a better state for the mashing tun; for if one barrel of malt taken from the kiln weighs twelve stone, let it remain on a dry loft for a few days, and from the moisture and vivifying qualities the external air is possessed of, it would greatly increase its weight, and enhance its value to the brewer. Yet many in this country are obliged to work their malt in a very few days after being made, in which state they will never work to advantage for either brewer or distiller.

If on the kiln you give in the first instance too great a heat to your malt, you blow it (as it is

is called) which is occasioned by a sudden transition from cold to heat, that causes the fixed air in the grain to expand with rapidity; and, as the great heat diffuses its virtue, and highly rarifies the air, it has no way to escape, but through the bed of six inches diameter, that the grain lies on; and as it passes thus through, it fastens on each distinct grain and deposits a certain portion of its heat, and, in the contest between fire and water, there is thrown from the surface of the goods on the kiln an aqueous vapour; and, as the damp is discharged from the grain by fire, heat possesses the space, and in about thirty-six or forty hours, the grain, that went on the kiln highly impregnated with water, comes off warm and perfectly dry, being divested of every thing but saccharine, and the husky coat, that is left to contain the sweet.

I have heard it said in both kingdoms, that, if the brewer and distiller could ascertain the precise degree of heat the malt was dried with on the kiln, it would be of infinite use for determining, at what heat he should admit his first liquors on that malt in the washing tun. But I am of opinion, that it would be of little service. Malts from the long lying after being taken from the kiln, (which ought to be the practice) and from the moisture, that they naturally imbibe in the sea or land carriage, are rendered mellow, and the superfluous

ous heat is softened and in a great measure lost. The distiller ought to give a preference to pale malt, nor ought it to undergo a greater degree of heat on the kiln, than about 130° . But how is this heat to be ascertained with any degree of accuracy? as each part of the kiln perhaps differs in its heat. For if you lay the bulb of the thermometer on the floor or lattice of the kiln, the metallic substance or the tiles retain a greater degree of heat, than they communicate to the corn even one inch from it; and if you apply the instrument in the centre of the malt, which would seem to be a proper place, it will materially differ; so that I would rather place the glass stationary, at the distance of twelve inches from the malt, where you may occasionally observe at what degree it stands, and by a little practice you can judge with some accuracy of the aggregate heat, that your malt was dried by.

The pale malt, which is made as nine is to ten to amber and brown malt put together, ought to receive a slow and regular degree of heat sufficient to eradicate all the aqueous particles and leave it perfectly cured, which it generally is at little more than 130° ; but the amber must receive perhaps 10° more heat for flavour as well as colour, and the brown malt intended for porter, &c. perhaps 30° higher than the amber, and therefore may be justly called toasted malt.

I shall

I shall now endeavour to point out the effect the different degrees of heat have on the pale, amber, and brown malts. By making a solution from the three different sorts, they will be found to produce nearly as follows. If the pale malt, for argument sake, deposits thirty pounds of saccharine or fermentable matter from twelve stone, the amber will not produce more than twenty-seven, and the highly dried brown malt not more than twenty-one, although all taken from the same heap originally; hence what is obtained in colour and flavour, is lost in strength and saccharum.

All malts, that are intended to lie for any length of time to meliorate, ought now and then to be turned and run from one loft to another, or to be fanned by the new invented instrument in the common air, which will keep them perfectly sweet and free from insects.

On the strictest examination of the corn, that has undergone the operation of the steep, flooring, &c. and is ready for the kiln, I have discovered, on an average, at least a one tenth of the grain, that had not shewn the least appearance to germinate, and that part not the smallest or inferior sort. But, to satisfy my curiosity, and to discover if possible this phenomenon, I sowed part of these grains in the ground, that had not
germinated

germinated on the floor, and in four days some of them vegetated: these grains we must suppose had not remained long enough in the steep, for their vegetating parts to be sufficiently loosened or set at liberty; but there still remained some of the same corn in the ground, that no time or art could bring forward: hence we must conclude, that barrenness is not entirely confined to the animal part of the creation. I am apt to believe, that some maltsters will doubt the truth of my assertion; but, that they may be fully satisfied as to the fact, let them open the husk on the back of the doubtful grains, and, if germinated, the acrospire will appear visibly; for the heat of the kiln does not in the least deface the blade, as it passes along the body of the corn; but were it possible, that every grain was let to continue on the floor, until the acrospire had grown nearly to the end of the grain without forcing its prison, the malt in general would be possessed of more saccharine, and less gross particles, and by that means be brought nearer the criterion; and each grain would become larger and lighter from the greater growth. But the fact is simply this, that the greater part of the malt, that is now brought to market, is little more than half grown on the back, until it is intentionally checked, so as to retain a greater portion of its original gravity, which method fully answers the intention of the maltsters for the

the present. But, if the acrospire was let to grow even a full three fourths of the grain, it would increase in sweetness, extend in size, and be an inducement to the maltsters of this kingdom to sell by measure (as in England) in preference to weight.

I shall conclude this treatise by endeavouring to point out the pernicious effects of working raw corn in part, or half made malt, and how it militates in particular against the brewer, and in a lesser degree against the distiller.

The small portion of saccharine, and of fermentable matter drawn from half made malt, or raw barley, in the mashing tun for brewing or distillation, is of a very different nature from the saccharine obtained from well made malt; yet it has been proved, that the barrel of corn never malted will produce more ardent spirits, than if the same quantity had been properly made into malt. but the spirits obtained from it are coarse, rancid, and unwholesome, and not fit for use without being highly rectified, and lying a considerable time to meliorate. But the spirits made from the saccharine of good malt are in the first instance possessed of a pleasing flavour, and require little time to mature. If this statement should be a true one, then how injurious to the brewer and distiller is the working
any

any part of raw corn or half made malt? But particularly it militates against the brewer more than the distiller, as he can, by rectifying the spirits, throw off a great portion of the oleaginous and earthy parts, while the brewer has no subterfuge, but time and patience; and this must continue, while they are obliged to work with such mixed malts, which I fear has proved one of the great barriers against their arriving at that degree of perfection they so ardently wished for. Examine the grains, when thrown from the mash tun, and you will see some whole, half, and smaller parts, that appear white, and are of a glutinous nature; these are principally the steely or unmalted parts of the corn, which absorb the aqueous and retain it; whereas perfect made malt readily unites with the liquor, and generously gives its sweet at an 140° of heat, while the hardness of these unground flinty grains would take 180° to extract their produce, so that being thus obliged to work these unequally made malts together, this last high degree of heat must harden, and materially injure the delicate farina of a well made malt: hence encouragement ought to be held out to the first maltsters, that shall make perfect malt for the breweries and distilleries of this kingdom.

Through

Through the chemical part of this treatise I have endeavoured to be as concise as possible, but I hope the learned will excuse me, where I must have appeared prolix, for the sake of conveying fully to the common capacity the instructions, conceiving the variety of hands this treatise may probably fall into.

F I N I S.

Through the channel of the
the embankment to be made in the
the tunnel will extend to where a small
new approach bridge for the road is being
the tunnel
the tunnel



TE